

Name Key
 Period Date

Combined Gas Law Problems

1. Use the following data to find P_2 in atm.

$$V_1 = 7.84 \text{ cm}^3$$

$$V_2 = 15.6 \text{ cm}^3$$

$$P_1 = 71.8 \text{ kPa}$$

$$P_2 = \text{_____ atm}$$

$$T_1 = 25.0^\circ\text{C} \quad 298 \text{ K}$$

$$T_2 = 0.0^\circ\text{C} \quad 273.0 \text{ K}$$

$$\frac{V_1 P_1}{T_1} = \frac{V_2 P_2}{T_2}$$

$$P_2 = \frac{T_2 V_1 P_1}{T_1 V_2}$$

$$= 326 \text{ atm}$$

$$\frac{273.0 \text{ K} \mid 7.84 \text{ cm}^3 \mid 71.8 \text{ kPa} \mid 1 \text{ atm}}{298 \text{ K} \mid 15.6 \text{ cm}^3 \mid \mid 101.3 \text{ kPa}}$$

2. When 3.50 L of CO_2 gas at 2.00 atm and 56.7°C is heated and compressed, the new pressure is 3.50 atm and the new temperature is 109.7°C . What is the new volume?

V_1

P_1

$T_1 \quad 329.7 \text{ K}$

$\cdot 326326$

V_2

P_2

$T_2 \quad 382.7 \text{ K}$

$$V_2 = \frac{T_2 V_1 P_1}{T_1 P_2}$$

$$\frac{382.7 \text{ K} \mid 3.50 \text{ L} \mid 2.00 \text{ atm}}{329.7 \text{ K} \mid 3.50 \text{ atm}} = 2.32 \text{ L}$$

3. The volume of a sample of gas is 200.0 mL at a temperature of 275 K and a pressure of 92.1 kPa. What will the new volume of this sample be if the temperature is increased to 350.0 K and the pressure is decreased to 78.6 kPa?

P_1

V_1

T_1

T_2

P_2

$$V_2 = \frac{T_2 V_1 P_1}{T_1 P_2} \quad \frac{350.0 \text{ K} \mid 200.0 \text{ mL} \mid 92.1 \text{ kPa}}{275 \text{ K} \mid 78.6 \text{ kPa}} = 298 \text{ mL}$$

$$T_1$$

$$298K$$

$$V_1$$

$$P_1$$

4. A sample of gas at 25.0 °C has a volume of 15.7 mL at a pressure of 760 torr. What is the new temperature (in K) of the gas if the pressure changes to 10.0 atm, and the volume changes to 18.9 mL?

$$\frac{V_1 P_1}{T_1} = \frac{V_2 P_2}{T_2}$$

$$\frac{T_1}{V_1 P_1} = \frac{T_2}{V_2 P_2}$$

$$T_2 = \frac{T_1 V_2 P_2}{V_1 P_1}$$

$$\frac{298.0K}{15.7mL} \times \frac{18.9mL}{760torr} \times \frac{10.0atm}{1atm}$$

$$T_2 = 3600 K$$

CONVERSION

5. A balloon man fills a balloon with 2.25 L of helium gas at ground level. The temperature is pleasant at 19.0 °C and it is sunny with a pressure of 770. mmHg. The balloon slips from the grasp of a small child and reaches at height of 1500 ft, where the temperature is 14.5 °C and the pressure is only 752 torr. What is the balloons new volume?

$$V_1 = 2.25 L$$

$$V_2 = ?$$

$$T_1 = 292 K$$

$$T_2 = 287.5 K$$

$$P_1 = 770. mmHg$$

$$P_2 = 752 torr$$

$$V_2 = \frac{T_2 P_1 V_1}{T_1 P_2}$$

$$\frac{287.5K}{292K} \times \frac{770mmHg}{752torr} \times \frac{2.25L}{760mmHg}$$

$$2.268... L$$

$$2.27 L$$